PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MIW/SS/41823	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/GB2004/001181	International filing date *(day/month/year)* 19.03.2004	Priority date *(day/month/year)* 20.03.2003
International Patent Classification (IPC) or national classification and IPC G01N21/88		
Applicant MOLINS PLC et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 6 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
14.10.2004	20.05.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Marzano Monterosso, Telephone No. +49 89 2399-2902

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/GB2004/001181

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-44	as originally filed
Claims, Numbers	
1-37	received on 27.01.2005 with letter of 20.01.2005
Drawings, Sheets	
1/8-8/8	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-37
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-37
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-37
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1: US-A-6 075 882 (MULLINS MICHAEL J ET AL) 13 June 2000 (2000-06-13)
D2: US-A-5 414 270 (HENDERSON CALVIN W ET AL) 9 May 1995 (1995-05-09)

2 Document D1, which is considered to represent the most relevant state of the art, discloses an apparatus for determining one or more physical properties of a rolled smoking article from which the subject-matter of claim 1 differs in that the processing means is adapted to determine one or more physical properties of the smoking article which relate to the diameter of said article.
The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

3 The problem to be solved by the present invention may be regarded as how to provide means to determine the variation of diameter of the smoking article over its length.
The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons: the apparatus of D1 is not adapted for measuring the diameter of a smoking article since it uses pulsed infrared light which passes through the cigarette and the edges of this latter would not be determined accurately.
On the other hand document D2 is adapted to inspect the external surface of the cigarette and does not give any indication of determining one or more physical properties relating to the diameter.

4 The same reasoning applies mutatis mutandis for independent method claim 23 which as well is considered to satisfy the requirements of Article 33(2) and (3) PCT with respect to novelty and inventive step.

5 Claims 2-22 and 24-37 are dependent on claims 1 and 23 respectively and as such also meet/s the requirements of the PCT with respect to novelty and inventive step.

Claims

1. Apparatus for determining one or more physical properties of a rolled smoking article or filter rod, said apparatus comprising:

imaging means defining a field of view, said imaging means being adapted for imaging a rolled smoking article or filter rod in said field of view;

means for positioning a smoking article or filter rod in said field of view such that the axis of the smoking article or filter rod is substantially orthogonal to the optical axis of the imaging means;

illuminating means for illuminating said field of view; and

processing means for processing said image to determine one or more physical properties of a smoking article or filter rod in said field of view;

wherein the processing means is adapted to determine one or more physical properties of the smoking article or filter rod which relate to the diameter of the smoking article or filter rod.

2. Apparatus as claimed in claim 1, wherein said imaging means are adapted for forming a digital image of said smoking article or filter rod.

3. Apparatus as claimed in claim 2, wherein said processing means are adapted for processing said digital image electronically for determining said one or more physical properties.

4. Apparatus as claimed in any of claims 1 to 3, wherein said processing means are adapted for repeatedly sampling said image.

5. Apparatus as claimed in any of claims 1 to 4, wherein said illuminating means are adapted to cast diffuse light onto said field of view.

6. Apparatus as claimed in claim 5, wherein said imaging means define an optical viewing axis and said illuminating means comprise one or more sidelights which are positioned laterally of said optical axis.

7. Apparatus as claimed in claim 6, wherein said illuminating means comprise two sidelights positioned on opposite sides of said optical axis.

8. Apparatus as claimed in any of claims 1 to 7, wherein said illuminating means comprise a backlight adapted for backlighting a smoking article or filter rod positioned in said field of view.

9. Apparatus as claimed in claim 8, wherein said backlight comprises an infra-red light.

10. Apparatus as claimed in any of claims 1 to 9 wherein said imaging means comprise a digital camera.

11. Apparatus as claimed in any of claims 32 to 41, further comprising means for rotating a smoking article or filter rod about its axis in said field of view.

12. Apparatus as claimed in claim 11, wherein said rotating means comprise two juxtaposed rollers, which rollers are positioned side-by-side so as to define a groove therebetween which groove is adapted to receive said smoking article or filter rod, and means for rotating one or both of said rollers thereby to cause said smoking article or filter rod to rotate.

13. Apparatus as claimed in claim 11 or claim 12, wherein said processing means are adapted for repeatedly sampling the image as a rolled smoking article or filter rod is rotated by said rotating means and processing each image sample to measure the diameter of said rolled smoking article or filter rod in each image sample and using the measurements to obtain one or more physical properties of said rolled smoking article or filter rod selected from the mean diameter, ovality, circumference, roundness and shape of said rolled smoking article or filter rod.

14. Apparatus as claimed in any of the preceding claims, wherein said processing means are adapted to locate in each image sample two opposite edges of the rolled smoking article or filter rod in profile and to calculate the distance between said opposite edges.

15. Apparatus as claimed in claim 14, further comprising control means for controlling said processing means, said control means comprising a database, which database is adapted to store a predetermined nominal diameter of said rolled smoking article or filter rod, said control means being adapted to define two laterally spaced regions of interest of said field of view corresponding to the nominal width, each of which regions of interest encompasses all likely positions of a respective one of the opposite edges, and said control means are configured to control the processing means to process each image sample only within said two regions of interest to locate said opposite edges.

16. Apparatus as claimed in any of the preceding claims, wherein said processing means are adapted to determine the diameter of said rolled smoking article or filter rod at two or more axially spaced locations on said rolled smoking article or filter rod.

17. Apparatus as claimed in any of the preceding claims, wherein said processing means are adapted to detect one or more circumferential markers on a rolled smoking article or filter rod which are capable of indicating its rotational orientation.

18. Apparatus as claimed in claim 11, or any of claims 12 to 17 when dependent on claim 11, further comprising control means adapted to control said rotating means in response to output from the processing means such that said rolled smoking article or filter rod is rotated through a complete revolution.

19. Apparatus as claimed in claim 11 or claim 12, further comprising control means for controlling said processing means, said control means comprising a database adapted to store data indicating the axial direction of a rolled smoking article which is axially asymmetric such that said rolled smoking article is directional, said processing means being adapted for repeatedly sampling said image as said rolled smoking article is rotated by said rotating means and processing each sample to detect the position of a shadow cast by a longitudinal seam of an outer layer of the rolled smoking article, said outer layer being wrapped circumferentially around said rolled smoking article to overlap itself thereby to form said seam, thereby to determine the

direction of wrapping of said outer layer relative to the direction of the rolled smoking article.

20. Apparatus as claimed in claim 19, wherein said database is further adapted to store a nominal width of said rolled smoking article, said control means being adapted to derive two laterally spaced regions of interest of said field of view based on said nominal width, each of said regions of interest encompassing all likely positions of said shadow depending on the direction of wrapping of said outer later, and to control said processing means to detect the presence of said shadow only in one of said regions of interest.

21. Apparatus as claimed in claim 19 or claim 20, wherein said sidelights are positioned obliquely relative to the optical axis to enhance the shadow cast by said seam.

22. Apparatus as claimed in claim 19, 20 or 21, wherein said processing means are adapted to determine the respective wrapping directions of two or more outer layers of a rolled smoking article, each of which outer layers is wrapped circumferentially around the rolled smoking article to overlap itself to form an axially extending seam.

23. A method of determining one or more physical properties of a rolled smoking article or filter rod, said method comprising disposing a rolled smoking article or filter rod within a field of view of an imaging means such that the axis of the smoking article or filter rod is substantially orthogonal to the optical axis of the imaging means, illuminating said field of view, imaging said rolled smoking article or filter rod within said field of view to form an image, and analysing said image to determine one or more physical properties of said rolled smoking article or filter rod, which relate to the diameter of the smoking article or filter rod.

24. A method as claimed in claim 23, wherein said image is a digital image.

25. A method as claimed in claim 24, characterised by electronically processing said digital image to determine said one or more physical properties.

26. A method as claimed in any one of claims 23 to 25, characterised by illuminating said field of view with diffuse light and using light reflected from said rolled smoking article or filter rod to form said image.

27. A method as claimed in any of claims 23 to 26, further comprising rotating said rolled smoking article or filter rod about its axis within said field of view and repeatedly sampling the image.

28. A method as claimed in claim 27, characterised by processing each image sample to measure the diameter of said rolled smoking article or filter rod in each image sample and using the measurements to obtain one or more physical properties of said rolled smoking article or filter rod selected from the mean diameter, ovality, circumference, roundness and shape of said rolled smoking article or filter rod.

29. A method as claimed in any of claims 23 to 28, characterised by determining the diameter of the rolled smoking article or filter rod in each image sample by processing the image sample to locate the two opposite edges of the rolled smoking article or filter rod in profile and calculating the distance between said opposite edges.

30. A method as claimed in claim 29, characterised by processing each image sample within two predetermined, laterally spaced regions of interest of said field of view to locate said two opposite edges, which regions of interest are determined on the basis of the nominal diameter of the rolled smoking article or filter rod.

31. A method as claimed in any of claims 23 to 30, wherein the diameter of said rolled smoking article or filter rod is measured at two or more axially spaced locations on said rolled smoking article or filter rod.

32. A method as claimed in claim 27, or any of claims 28 to 31 when dependent on claim 27, wherein said rolled smoking article or filter rod comprises one or more circumferential markers adapted to indicate the rotational orientation of the rolled smoking article or filter rod, and said processing step includes processing said samples to determine a complete revolution of the rolled smoking article or filter rod.

33. A method as claimed in claim 27, or any of claims 28 to 32 when dependent on claim 27, characterised by determining the axial direction of a rolled smoking article which is axially asymmetric such that said rolled smoking article is directional and comprises at least one outer layer which is wrapped circumferentially around said rolled smoking article to overlap itself thereby to form a longitudinal seam, and processing said image samples to determine the wrapping direction of said outer layer relative to the direction of said rolled smoking article.

34. A method as claimed in claim 33, wherein said image samples are processed to determine the position of said longitudinal seam by detecting the position of a shadow cast by said seam as the rolled smoking article rotates.

35. A method as claimed in claim 34, characterised by processing each image sample to detect the presence of said shadow in two predetermined, laterally spaced regions of interest being determinative of the direction of wrapping of the outer layer, the regions of interest being determined on the basis of a predetermined nominal width of the rolled smoking article.

36. A method as claimed in claim 34 or claim 35, characterised by illuminating said rolled smoking article obliquely to enhance the shadow cast by said seam.

37. A method as claimed in any of claims 33 to 36, wherein said rolled smoking article comprises two or more outer layers, each of which outer layers is wrapped circumferentially around the rolled smoking article to overlap itself to form an axially extending seam, and said image is processed to determine the wrapping direction of each outer layer relative to the direction of the rolled smoking article.